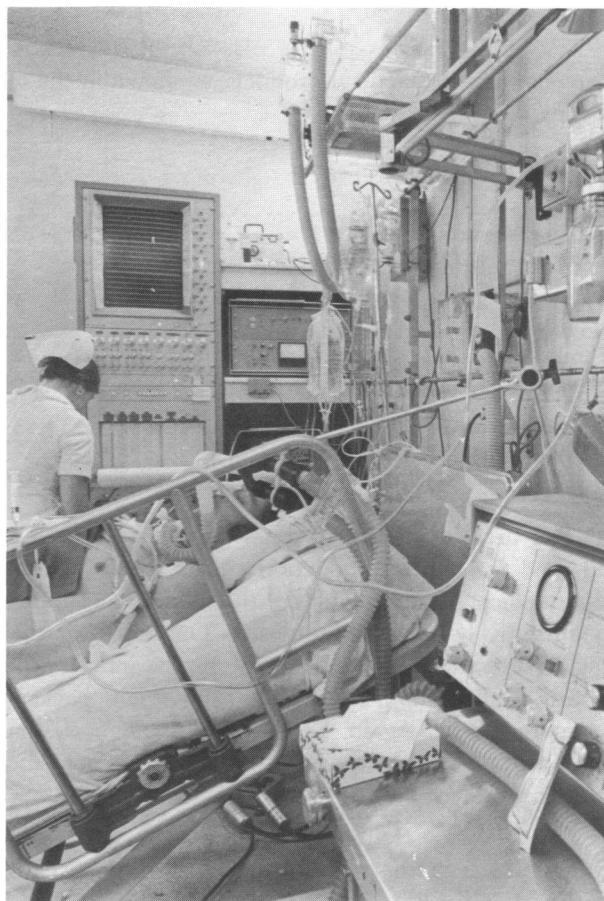


Impact of Oil Shortage on Plastic Medical Supplies

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IN ANY DISCUSSION of the impact of an oil shortage on the delivery of health care, medical supplies are usually given short shrift, whereas fuel and BTUs are usually the major topics. Most health professionals who profess knowledge of the oil and petrochemical industry immediately table the medical plastics issue. The crux of the matter is that plastic medical supplies represent only 0.2 percent of the oil consumed in this country. Since 0.2 percent is so small a percentage of such an immense industry, no problem is perceived in satisfying the needs of the medical plastics industry—even in an oil crisis. If anything is predicted to happen, costs will increase but the industrial apologists affirm that “those costs will be met.” Ultimately, if one tries to point out that in past oil shortages there was a serious shortfall of plastic medical equipment supplies, the same skeptics challenge with “Name two examples!” We can name more than two.

Plastic medical supplies do indeed represent a minuscule portion of the petrochemical oil industry quantitatively. However, contrary to popular belief, plastic sup-



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plies that are critical for medical life support are still heavily susceptible to serious shortfall in time of oil shortage crisis regardless of the diminutive amount of oil used in their production.

Economics of Plastics

The percentages of oil used by fuel consumption and plastic production in the United States in 1950 and 1970 were as follows:

Petroleum	1950	1970
Total fuel usage	99.0	94.0
Transportation	51.0	50.0
Residential-commercial	23.0	21.0
Industrial	20.0	16.0
Electric utilities	5.0	7.0
Plastic industry usage	0.7	5.0

It is logical that the lion's share of the expenditure of oil is for fuel. In 1950 the percentage of oil used for plastics production was only 0.7 percent (14 million tons). By 1970, however, that percentage was 5 percent (72 million tons), representing a 500 percent increase in plastic production in 20 years (1). By the year 2000 how much more demanding will petrochemicals be on the petroleum industry?

Among the various uses of plastic in 1972, about 4 percent were for medical products, as shown in the following table (2).

Uses	Percent
Packaging	21
Building construction	10
Exports	7
Electronics	6
Transportation	5
Housewares	5
Furniture	4
Medical	4
Toys	3
Appliances	3
Miscellaneous (marine, sports, luggage, textiles, and others)	23

That 4 percent multiplied times the 5 percent of total oil used for plastic production equals the 0.2 percent that medical plastics require of the nation's oil supply—quantitatively not very impressive. One item, "packaging," represents 21 percent of the plastic industry, and plastic medical supplies are almost universally packaged in more plastic. Again, by the year 2000, how much more will the health care industry depend upon medical plastic products?

The following characteristics of plastic contribute to its usefulness in the manufacturing of medical equipment.

Soft or hard	Shock absorbent
Transparent or opaque	Electrically insulative
Multicolored	Chemically inert
Elastic or tensile	Heat resistant
Variable strength	Heat sealable
Lightweight	Moisture proof
Dimensionally stable	Economical
Accurately sized	Competitive
Moldable	Mass produced
	Disposable

Any combination of three or four of these characteristics make plastic an extremely attractive, merchandisable product. As a spinoff of the low cost and high versatility of plastic, a most desirable attribute of plastic medical supplies is that they can be used once and then disposed of.

Whether a physician is debriding wounds in a battalion aid station or a tiled civilian treatment room, the use of plastic masks, plastic gloves, and plastic in tubing is a common denominator. Even in these relatively simple settings, plastics are necessary to insure aseptic, state of the art, medical and surgical techniques and ancillary laboratory and nursing support.

The following list is representative of the large number and wide variety of plastic medical supplies that are directly important in medical-surgical life support.

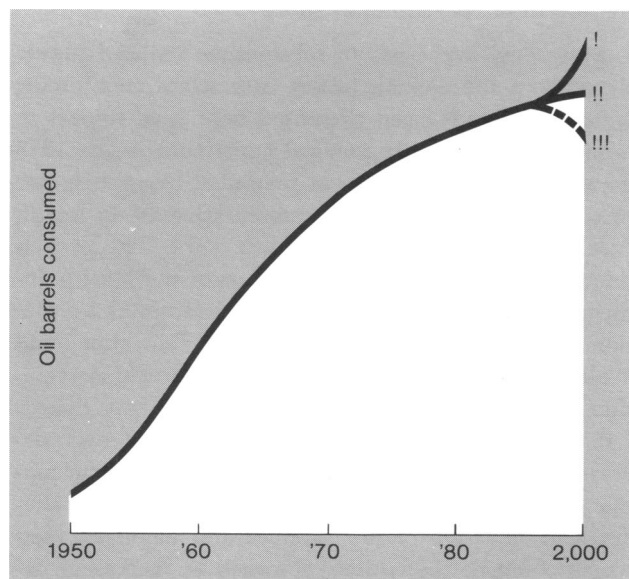
- Airways
- Anesthesia
- Bags (blood, intravenous fluid, sterilizing, specimen)
- Catheters (intravenous, endotracheal, nasal, spinal, umbilical, urethral)
- Dishes (bacteriological)
- Drains (surgical)
- Gloves (examining, surgical)
- Heart valves
- Hood (oxygen)
- Infusion sets (blood, intravenous fluid)
- Needles
- Syringes
- Tubes (laboratory)
- Tubing (suction, infusion, laboratory, grafting)

We must ask ourselves what we would do without these and the other plastic items which have become so important to everyday medical care. It should be alarming that our medical supply support is largely comprised of plastic products and that direct patient care depends upon a plastic-oriented technology on the ward and in the laboratory.

Survey of Effects of the Embargo

In 1800, Malthus used a graph similar to the one presented here to illustrate his prediction of the world's population eventually outstripping the world's food supply; his prediction has been forestalled by the industrial revolution. Today, academic centers such as MIT and think tanks such as Rand Corporation use the same type of graph to illustrate similar predictions of the world's technology outstripping the world's oil supply; such a

Availability of oil, 1950–2000



graph has been referred to in some circles as a “doomsday model.” The fate of the world’s population or modern civilization by the year 2000 with respect to the shortage of oil for fuel and petrochemical products may be forestalled only by another technological revolution.

For the sake of critical analysis and future planning, we should use recent fluctuations in oil supply as a means to study the response of the plastic medical supply industry to critical oil shortage. For instance, in the 1973 embargo were there significant shortfalls of medical plastics or was that industry as immune to shortfall as apologists for the industry claim? Would not the 1973 embargo be a reasonable “in vivo” experiment from which one could document results and predict medical supply adequacy in time of future embargos (trade loss) or war (trade and shipping loss)?

Federal and industrial reports of petroleum fuel and petrochemical production during the 1973 embargo revealed, as shown in the following table, a 15 percent shortfall in petroleum supply (3).

Shortfall ¹	Percent
Transportation	17
Household-commercial	17
Industrial	5
Overall	15
GNP loss	3–9

¹ Plastics not reported.

Fuel production certainly was decreased. It is interesting, however, that plastics production was not reported in any of the major reports reviewed.

As a result of the embargo the gross national product

(GNP) was decreased by 3–9 percent, depending on which report is read. The drop in the GNP was equivalent to a loss of about \$15 billion and an increase in unemployment by about 500,000 (4). The loss of employment by the automotive companies in Detroit alone at the time of the embargo will long be remembered. The country was on its way to an economic recession for that brief period.

In the face of such severe economic effects of the 1973 oil embargo, the medical plastics industry demonstrated comparatively minor setbacks that did not draw the attention of the major Federal and industrial studies of the embargo. We submit, however, that even though no major plastic shortage was reported in the United States, there was still significant evidence of a real shortfall that portended grave consequences for the medical plastics supply industry if the embargo had lasted long enough—a few more months—to outstrip whatever cushion effect that inventory reserves may have provided.

To document such a shortfall objectively, pro or con, one of us (Clark), in late 1977, surveyed commercial producers of plastic feedstock and manufacturers of finished supplies, on one hand, and consumers of those supplies, on the other. The survey was based on producer and consumer experiences during the 1973 embargo. The consumers surveyed were from the military sector of the health care industry, their experience easily reflecting similar experiences by civilian consumers. The survey methodology was as follows. One plastic feedstock manufacturer, five plastic syringe manufacturers, and three military consumer groups (Defense Personnel Support Center, U.S. Army Medical Materiel Agency, and Walter Reed Army Medical Center) were sent a letter of inquiry. Plastic syringes were used as a test item because they are commonly employed and clinically important. All were asked to relate their 1973 embargo experience with feedstock or finished-product shortfall, and they were asked to comment on alternative options for types and sources of feedstock or construction material. The producers were asked if they could retool in an emergency. Use of the Defense Priority System was also covered.

The summation of results of the survey is as follows: The manufacturers expressed a total technological investment and complete commitment to syringes made of plastic. Although half of the manufacturers accepted glass as an alternative emergency option to plastic in the manufacturing of syringes, only one company was really capable of retooling for glass syringe manufacturing within any reasonable amount of time. There was no evidence of alternative options for other sources of feed-

stock, types of feedstock, or nonplastic (for example, glass) material that could be used in time of shortage.

Several of the companies reported increased lead time in delivery of feedstocks and in shipment of finished syringes during the 1973 embargo. The cost of feedstocks was increased. There was a documented shortage of benzene and ethylene feedstock.

Only one company expressed awareness and use of the Defense Priority System (DPS), and that attempt to gain Federal support by priority was not successful; Federal support of medical plastics through the DPS was not being favored. No company attested to significant interest in contingency plans for another oil supply crisis in terms of planning for feedstock or plastic emergency stockpiling.

The survey revealed that at the consumer level a similar degree of shortfall was experienced in terms of increased delivery lead time and increased cost. At neither the Defense Personnel Support Center, the U.S. Army Materiel Agency, nor the primary care level at the Walter Reed Army Medical Center were any contingency plans reported for the meeting of another oil supply crisis in terms of emergency plastic supply stockpiling, glass supply stockpiling, or plans for reesterilization of disposable plastic products. No apparent concern about a shortfall problem was evident. It was as if the 1973 embargo would never be repeated; if such an embargo would re-occur we could somehow take care of the problem when it happens.

Correlative Findings

Some other correlative findings support the survey findings. On one hand, no significant comments appeared in the U.S. medical literature regarding concern over impending plastic equipment shortages. This silence was supporting evidence of the apparent naivete of the U.S. health care industry, both military and civilian. On the other hand, U.S. plastic-industry trade journals documented shortfall among the feedstock manufacturers, including specific references to benzene and ethylene shortages (5-7).

It is also of some interest that the British experience in 1973 was an equally valid "in vivo" experiment in observing health care industry reaction to the same severe oil shortage. England did not enjoy such a sizable cushion effect of inventory reserves as did the United States. Consequently, unlike the U.S. literature, British medical literature contained many articles expressing concern over shortage of plastic supplies, addressing contingency options such as reesterilization of disposables and use of glass, and issuing warnings of potential

problems such as increased hepatitis transmission with the return of reesterilization (8-12).

More evidence exists to substantiate realized plastic shortfall in the civilian health care sector, reinforcing what has already been presented here with respect to industrial and military medical experience in the 1973 embargo. Such evidence was presented by participants in an emergency meeting of representatives of the health care industry in Chicago, February 1974. The participants voiced the concern of members of the Health Industries Association (HIA), American Hospital Association (AHA), Department of Health, Education, and Welfare (DHEW), American Pharmaceutical Association (APA), Teamsters Union, and Federal Energy Office (FEO). The HIA expressed concern over decreased availability of plastic feedstocks for plastic supplies. The AHA reported significant increases in delivery lead time for plastic supplies and increased costs which could not be entirely absorbed by increasing patients' charges.

At the same meeting it was heard that the APA was alarmed over the decrease in plastic feedstocks from which synthetic drugs such as psychotropics and antibiotics are manufactured. The question was asked as to how this country's current trend of treating most psychiatric diseases on an outpatient basis through psychotropic drug therapy would fare in the event of a shortage of tranquilizers and other psychotropic drugs. How would we cope with a shortage of antibiotics?

It was also noted that increasing costs of shipment of plastic supplies was creating a seriously escalating cost to the health industry. Since plastics are a low-density, high-volume cargo, the truckers were having to charge disproportionately higher shipment fees because of rising fuel costs and were still obliged to charge the client on the basis of relatively low shipment weight per volume.

As for government support, it was reported at the meeting that the FEO advised that the health care industry as a whole would not be receiving any priority for fuel or oil allocation for heat or plastic feedstocks. Supply would be on a first come, first served basis. There would be no Federal restraint or control of rising costs of feedstock material.

As a final facet of the medical plastics contingency planning problem, it should be pointed out that the few contingency plans designed to stockpile War Reserve Inventory (WRI) of emergency medical supplies have been seriously compromised in recent years. In the past 2 to 3 years the Government Accounting Office has directed that the WRI not be resupplied with plastic medical supplies (13). Instead, it is planned to obtain

such supplies from civilian stocks, commercially, whenever needed in an emergency. Obviously this type of contingency planning will place another burden upon limited inventory stockpiles. As a consequence of relying upon commercial plastic supplies in an emergency, the military and civilian health care sectors will be vying for the same essential commercial supply inventory from the very onset of any future oil shortage crisis, regardless of the cause. This stockpiling problem will be compounded by the fact that many of our feedstocks and plastic supplies are already procured on the foreign market which, during a crisis, is obviously going to be the first source of supply to disappear.

Comments

The following represents a summation of suggested contingency planning to meet the preceding challenges:

- The stockpiling of strategic oil reserves must be accomplished as originally outlined by Project Independence in 1975. Many problems are currently coming to light regarding this stockpiling effort; it has fallen behind schedule but must be accomplished.
- Likewise, there must be emergency-strategic stockpiling of plastic feedstock supplies above and beyond what we have in the form of current inventory and FDA-required feedstock in quality control limbo.
- There must be some resolution of the plastic medical supply War Reserve Inventory stockpile problem; we must replenish those plastic supplies when required and not bank on commercial procurement in time of disaster.
- The Defense Priority System should be prepared to respond to the health care industry in support of plastic medical feedstock allocations.
- Research and development of alternatives to sources of feedstock (for example, coal and trees) must be encouraged.
- Research and development of reesterilization of plastic medical supplies must be supported.
- Contingency plans and preparations for retooling toward manufacturing of glass supplies must be established. In this regard, it is not sufficient just to plan on paper but also it is advisable to prepare physically.

Consumers of medical plastics should champion the preceding Federal and manufacturer improvements. In addition, the consumers should implement their own contingency plans for dealing with a medical plastic shortfall in an oil supply constraint situation. Such plans must address the need for decreasing dependency on disposables, reesterilization of certain plastic items, and coping with the increased risk of hepatitis.

In summation, there is good evidence that production of plastic medical equipment may be a minuscule fraction of the overall petrochemical industry; yet, it is not immune to serious supply shortfall in an oil shortage crisis of either economic or military nature. In support of this allegation, we have introduced documented evidence that the U.S. health care industry experienced plastic supply shortfall in the form of increased lead time and cost as a direct result of the 1973-74 embargo. The industry was fortunate in that there was some cushion effect from residual inventories and that the embargo did not last longer. As a further example, it has been shown that the British industry was not so fortunate; it experienced definite signs of medical plastic shortfall and reaction by the medical profession.

The U.S. industry, from manufacturer to consumer, lacks contingency planning in spite of lessons learned from the last embargo. Contrary to the apparent consensus of popular opinion, "plan" is more than a four-lettered word. More planning and implementation is required if the U.S. health care industry is to be ready to cope with the next oil shortage crisis.

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